

IN THE SPECIFICATION

Please substitute the following paragraphs in the specification for corresponding paragraphs previously presented. A copy of the amended specification paragraphs showing current revisions is attached.

- The paragraph beginning at page 1, line p:

A' The present invention relates to a fluid flow measuring apparatus.

- The paragraph beginning at page 1, line 12:
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A thermal-type flow meter is used as a flow measuring apparatus to measure the amount of intake air for an internal combustion engine of automotive vehicles or the like. In an engine of not more than four cylinders, intake air pulsation increases when it is in a low rotational speed and high load condition. If opening periods of an intake valve and an exhaust valve overlap when the intake air flow is pulsating, the intake air is likely to flow in a reverse direction through the intake valve when a piston moves upward. The air flowing in reverse also is detected as an additional intake air flow amount. As a result, the amount of intake air flow which is actually sucked into the combustion chamber cannot be detected accurately.

[The paragraph beginning at page 1, line 24:]

A² A flow meter disclosed in JP-B2-62-14705 measures intake air flow by correcting average flow based on engine operating condition parameters such as engine rotational speed and throttle opening, so that fluid flow may be measured as a function of the direction of fluid flow. However, intake air flow amount cannot be measured with high accuracy, because intake air pulsation accompanied by reverse flow cannot be simply determined from engine rotational speed and throttle opening.

The paragraph beginning at page 2, line 8:

A³ A flow meter disclosed in JP-A-61-213728 determines that intake air flow direction is reversed when a plurality of singular points of a function appear in detected flow amount values. It is however difficult to accurately detect reversal of the intake air flow from detection of the singular points of a function, because pulsation in intake air flow is influenced largely by types of engines and intake air duct configurations.

[The paragraph beginning at page 2, line 16:]

A flow meter disclosed in JP-A-1-185416 detects intake air flow direction from a difference between detection signals of two heaters disposed at an upstream side and a downstream side of a planar substrate. However, control circuit construction is complicated, because two control circuits are required to detect signals from each heater. In addition, the temperature change rate of each heater at the time of heating operation

may differ from each other, because it is difficult to match control constants of the two control circuits. Errors will occur in the difference between temperatures of the heaters, thus disabling an accurate detection of intake air flow direction.

[The paragraph beginning at page 3, line 1:]

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cont. Flow meters and flow speed sensors disclosed in JP-A-8-14978, JP-A-60-142268 and JP-A-6-160142 detect intake air flow direction from a difference between detection signals of two temperature sensors which are disposed at an upstream side and a downstream side of a heater. However, a sensing part including an intake air temperature sensor becomes large and the heat capacity of the sensing part increases, because the temperature sensors are disposed upstream and downstream of the heater. As a result, detection sensitivity and responsiveness of the flow meter will be lessened.

[The paragraph beginning at page 3, line 11:]

A flow meter disclosed in JP-A-10-62220 expands the measurable range and decreases the ratio of noise relative to an output signal by arranging a heater to surround a group of temperature measuring resistors and increasing the difference between the temperatures of temperature measuring resistors of the group disposed at an upstream side and a downstream side in the group with respect to fluid flow direction. However, a sensing part becomes large and the heat capacity of the sensing part increases, because

the heater surrounds the group of the temperature measuring resistors. As a result, detection sensitivity and responsiveness of the flow meter will be lessened.

[The paragraph beginning at page 3, line 23:]

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cont. It is an object of the invention to provide a small-sized flow measuring apparatus which detects flow amount with high accuracy irrespective of fluid flow direction.

[The paragraph beginning at page 3, line 26:]

According to a preferred embodiment of the present invention, a heater is strip-shaped in a manner that each strip turns at a plurality of points and has a width in a flow direction. The temperature of the heater is controlled to a reference temperature determined in correspondence with a temperature detected by a fluid temperature detector. A flow amount detector is disposed at only one of an upstream side and a downstream side of the heater with respect to one fluid flow direction, so that fluid flow amount varying with fluid flow direction is detected from the temperature detected by the flow amount detector.

The paragraph beginning at page 15, line 27:

A4 In a sixth embodiment shown in Figs. 12A, 12B and 13, the intake air temperature detectors 20 and 22 are disposed at locations where the heat of the heater 30 does not influence the intake air temperature detecting operations. The control circuit is

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constructed as shown in Fig. 13 so that the temperatures, that is, resistances, of the flow amount detector 21 and the intake air temperature detector 22 function as the fluid temperature detector. The potential at the junction 52 between the intake air temperature detector 22 and the fluid amount detector 21 which changes its temperature in response to changes in the intake air temperature does not change. It rather changes in response to the intake air flow amount and the direction of the intake air flow which the fluid amount detector 21. Therefore, the intake air flow direction and the intake air flow amount are measured irrespective of changes in the intake air temperature by applying the potential at the junction 52 and a predetermined fixed potential to one and the other inputs of the amplifier 46, respectively.

The paragraph beginning at page 19, line 7:

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In the foregoing embodiments for implementing the present invention, the intake air flow amount is detected while taking into consideration the intake air flow direction by determining whether the temperature detected by the flow amount detector 21 is higher or lower than the reference temperature. However, the temperature detected by the flow amount detector 21 responds to changes in the distance between the flow amount detector 21 and the heater. For instance, if the flow amount detector 21 is distanced away from the heater, the temperature detected by the flow amount detector 21 may become lower than the reference temperature even if the flow amount detector 21 is located at the downstream side of the heater with respect to the intake air flow in the forward direction.